

# Molybdenum

CAS No. 7439-98-7

## General Information

Elemental molybdenum is a silver-white, hard metal with many commercial uses, including the production of metal alloys. Compounds of molybdenum are used as corrosion inhibitors, hydrogenation catalysts, lubricants, alloys in steel, chemical reagents in hospital laboratories, and in pigments for ceramics and paints.

Molybdenum is a nutritionally essential trace element and enters the body primarily from dietary sources.

Molybdenum enters the environment from the weathering of ores that contain it and from water containing the metal in its soluble forms (e.g., molybdates). In industry, dust and other fine particles produced during the refining or shaping of molybdenum are the most important sources of exposure. Workplace air standards for external exposure are generally established (OSHA, ACGIH). Generally, molybdenum has low or unknown toxicity. Some molybdenum compounds (e.g., molybdenum trioxide) may be animal carcinogens (NTP), but human carcinogenic risk is unknown (U.S. EPA). Information about external exposure (environmental levels) and health effects is available from the EPA IRIS Web site at <http://www.epa.gov/iris>.

**Table 23. Molybdenum**

Geometric mean and selected percentiles of urine concentrations (in µg/L) for the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
<b>Total, age 6 and older</b>	34.3 (29.4-40.1)	7.80 (2.90-11.6)	21.9 (18.2-25.7)	47.6 (42.8-52.2)	81.3 (75.9-87.8)	131 (124-143)	174 (153-201)	2465
<b>Age group</b>								
6-11 years	61.4 (47.8-79.0)	19.5 (<LOD-36.3)	44.4 (33.2-59.8)	81.4 (68.9-95.9)	126 (107-144)	178 (145-259)	259 (159-840)	340
12-19 years	33.4 (24.1-46.3)	3.00 (<LOD-17.2)	22.9 (16.3-32.8)	53.7 (46.0-65.3)	89.4 (79.0-97.5)	139 (113-166)	169 (146-216)	719
20 years and older	31.9 (27.3-37.3)	6.70 (4.00-11.0)	20.0 (15.8-23.4)	43.1 (39.6-47.6)	74.5 (71.5-79.5)	125 (112-129)	164 (143-195)	1406
<b>Gender</b>								
Males	39.0 (32.0-47.4)	9.40 (<LOD-15.3)	26.0 (21.4-32.0)	53.9 (47.3-62.5)	88.7 (80.9-102)	145 (129-168)	201 (168-251)	1227
Females	30.4 (25.5-36.3)	5.60 (1.40-10.4)	18.1 (13.1-22.2)	41.7 (38.0-47.5)	75.2 (70.2-80.3)	116 (106-126)	152 (135-166)	1238
<b>Race/ethnicity</b>								
Mexican Americans	29.3 (23.0-37.4)	< LOD	19.2 (12.9-27.0)	49.2 (43.1-54.8)	76.7 (70.2-85.9)	116 (104-129)	141 (124-199)	884
Non-Hispanic blacks	46.6 (39.2-55.3)	13.8 (9.50-21.2)	31.8 (27.4-36.1)	59.7 (53.6-67.9)	95.2 (84.8-108)	150 (127-174)	201 (154-254)	568
Non-Hispanic whites	33.4 (27.3-40.9)	5.60 (<LOD-12.0)	20.6 (15.8-25.8)	45.2 (40.3-51.4)	80.9 (74.0-91.6)	131 (121-146)	175 (152-218)	822

< LOD means less than the limit of detection, which is 0.6 µg/L.

## Interpreting Urine Molybdenum Levels Reported in the Tables

Urine molybdenum levels were measured in a subsample of NHANES participants aged 6 years and older. Subsamples were randomly selected within the specified age range to be a representative sample of the U.S. population. Finding a measurable amount of molybdenum in urine does not mean that the level of molybdenum causes an adverse health effect. Because molybdenum is an essential element for good health, intake and loss in the urine is expected. One study of a small number of college students found that high molybdenum intakes were associated with high urinary levels (mean  $187 \pm 34$   $\mu\text{g}/24$  hr) without apparent health

effects (Tsongas et al., 1980). Molybdenum is conserved at low intakes, and urinary losses are greater with high intake (Turnlund et al., 1995). Copper intake can alter the absorption, excretion, and effects of molybdenum. Among infants, urinary molybdenum concentrations may be slightly lower (Sievers et al., 2001). Other factors (e.g., dietary composition) that may increase or decrease molybdenum excretion are unknown.

Levels documented in this *Report* are similar to levels found in a previous non-random subsample of the U.S. population from NHANES III (1988-1994) (Paschal et al., 1998) and roughly similar to levels in several different populations (White et al., 1998; Komaromy-Hiller et al., 2000). Also, urinary molybdenum levels of

**Table 24. Molybdenum (creatinine adjusted)**

Geometric mean and selected percentiles of urine concentrations (in  $\mu\text{g}/\text{gram}$  of creatinine) for the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
<b>Total, age 6 and older</b>	32.3 (27.9-37.4)	12.9 (7.95-17.4)	26.3 (24.4-27.9)	39.4 (37.4-42.5)	61.5 (56.7-65.9)	104 (93.2-112)	132 (122-161)	2465
<b>Age group</b>								
6-11 years	67.3 (52.7-86.0)	35.1 (2.22-49.5)	58.8 (49.5-65.2)	77.0 (70.7-87.4)	120 (95.1-131)	173 (130-242)	203 (154-1040)	340
12-19 years	25.2 (17.8-35.6)	6.63 (.223-22.2)	25.9 (19.7-30.3)	37.9 (34.3-42.8)	54.4 (48.4-62.5)	80.7 (65.8-101)	103 (80.7-131)	719
20 years and older	30.6 (26.5-35.4)	12.5 (7.94-16.7)	25.1 (22.9-27.0)	37.4 (34.4-39.6)	54.9 (52.9-59.6)	88.1 (77.8-100)	119 (112-147)	1406
<b>Gender</b>								
Males	30.4 (25.6-36.1)	12.0 (7.34-16.0)	24.5 (21.6-26.7)	37.4 (33.7-39.6)	60.3 (54.3-66.9)	97.8 (83.9-113)	129 (118-161)	1227
Females	34.2 (28.9-40.4)	14.9 (2.11-20.8)	28.4 (26.3-30.3)	42.4 (39.2-45.2)	61.7 (56.5-68.6)	108 (95.2-119)	141 (120-173)	1238
<b>Race/ethnicity</b>								
Mexican Americans	27.1 (21.3-34.4)	< LOD	25.5 (21.5-28.7)	39.9 (36.5-42.9)	59.2 (55.2-63.1)	85.6 (77.5-93.7)	114 (91.6-131)	884
Non-Hispanic blacks	30.3 (25.4-36.1)	13.7 (8.19-16.9)	23.5 (21.6-25.7)	35.7 (32.8-38.5)	55.1 (49.9-60.3)	88.1 (71.6-104)	119 (88.4-141)	568
Non-Hispanic whites	33.5 (27.9-40.3)	13.3 (2.11-19.4)	26.5 (24.3-28.8)	39.6 (37.3-44.1)	62.3 (55.1-70.5)	112 (97.3-122)	170 (130-188)	822

< LOD means less than the limit of detection (see previous table).

adults in two smaller studies (Iversen et al., 1998; Allain et al., 1991) generally corresponded to the concentrations in this NHANES 1999-2000 report. In the current NHANES 1999-2000 subsample, geometric mean levels of the demographic groups were compared after adjustment for the covariates of race/ethnicity, age, gender, and urinary creatinine. Urinary molybdenum levels were higher for 6-11 year olds than for people aged 12-19 years, with both age groups having higher levels than people in the 20 years and older group. Non-Hispanic blacks had slightly lower levels than non-Hispanic whites. It is unknown whether differences between ages or races/ethnicities represent differences in exposure, body-size relationships, or metabolism.

These urine molybdenum data provide physicians with a reference range so that they can determine whether people have been exposed to higher levels of molybdenum than those found in the general population. These data will also help scientists plan and conduct research about molybdenum exposure and health effects.